

WHAT IS CLAIMED IS:

1. A waveguide assembly comprising:
a waveguide region comprising:
a longitudinally extending core, wherein the core includes an input
5 channel and at least one output channel; and
a cladding at least partially surrounding the core for confining signals
within the core; and
at least one photonic crystal (PhC) region extending laterally through at least a
portion of the core to at least partially direct signals propagating through the core.
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2. A waveguide assembly according to Claim 1, wherein the at least one PhC
region extends laterally through at least a portion of the core to thereby form a bend for
signals propagating through the core.
- 15 3. A waveguide assembly according to Claim 2, wherein each PhC region
includes a boundary layer at a boundary of the PhC region and the core of the waveguide
region, and wherein the boundary layer is capable of being modified to thereby
manipulate a diffraction effect caused by a periodicity at the boundary of the at least one
PhC region and the core.
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4. A waveguide assembly according to Claim 3, wherein the boundary layer
of each PhC region comprises an array of a plurality of one of holes and posts, and
wherein the boundary layer is capable of being modified by changing at least one of a
radius, periodicity and position of the one of holes and posts of the boundary layer.
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5. A waveguide assembly according to Claim 1, wherein the at least one PhC
region extends laterally through at least a portion of the core to thereby form a
beamsplitter for signals propagating through the core.

6. A waveguide assembly according to Claim 5, wherein the at least one PhC region extends laterally through at least a portion of the core to thereby form a polarizing beamsplitter for signals propagating through the core.

5 7. A waveguide assembly according to Claim 6, wherein a portion of the core through which the at least one PhC region extends can be configured to follow a propagation direction of polarized signals propagating through the core.

8. A waveguide assembly according to Claim 7, wherein the at least one
10 output channel comprises first and second output channels, and wherein a portion of the first output channel through which the PhC region extends is sloped with respect to the input channel.

9. A waveguide assembly according to Claim 1, wherein the at least one PhC
15 region extends laterally through at least a portion of the core to thereby form a Mach-Zender interferometer for signals propagating through the core.

10. A waveguide assembly according to Claim 1, wherein the at least one PhC region extends laterally through at least a portion of the core to thereby form a ring
20 resonator for signals propagating through the core.

11. A waveguide assembly according to Claim 1, wherein the at least one PhC region further extends laterally through at least a portion of the cladding such that the at least one PhC region is capable of covering the incident light mode width of a signal
25 propagating through the waveguide region.

12. A waveguide assembly according to Claim 1, wherein signals having a wavelength outside a band gap of the at least one PhC region are capable of propagating through the core.

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13. A waveguide assembly comprising:

a waveguide region including a longitudinally extending core; and
at least one photonic crystal (PhC) region extending laterally through at least a
portion of the core to at least partially direct signals propagating through the core,
wherein the signals are capable of having a wavelength outside a band gap of the at least
5 one PhC region.

14. A waveguide assembly according to Claim 13, wherein the at least one
PhC region extends laterally through at least a portion of the core to thereby form a bend
for signals propagating through the core.

15. A waveguide assembly according to Claim 14, wherein each PhC region
includes a boundary layer at a boundary of the PhC region and the core of the waveguide
region, and wherein the boundary layer is capable of being modified to thereby
manipulate a diffraction effect caused by a periodicity at the boundary of the at least one
15 PhC region and the core.

16. A waveguide assembly according to Claim 15, wherein the boundary layer
of each PhC region comprises an array of a plurality of one of holes and posts, and
wherein the boundary layer is capable of being modified by changing at least one of a
20 radius, periodicity and position of the one of holes and posts of the boundary layer.

17. A waveguide assembly according to Claim 13, wherein the at least one
PhC region extends laterally through at least a portion of the core to thereby form a
beamsplitter for signals propagating through the core.

18. A waveguide assembly according to Claim 17, wherein the at least one
PhC region extends laterally through at least a portion of the core to thereby form a
polarizing beamsplitter for signals propagating through the core.

19. A waveguide assembly according to Claim 18, wherein a portion of the core through which the at least one PhC region extends can be configured to follow a propagation direction of polarized signals propagating through the core.

5 20. A waveguide assembly according to Claim 19, wherein the at least one output channel comprises first and second output channels, and wherein a portion of the first output channel through which the PhC region extends is sloped with respect to the input channel.

10 21. A waveguide assembly according to Claim 13, wherein the at least one PhC region extends laterally through at least a portion of the core to thereby form a Mach-Zender interferometer for signals propagating through the core.

15 22. A waveguide assembly according to Claim 13, wherein the at least one PhC region extends laterally through at least a portion of the core to thereby form a ring resonator for signals propagating through the core.

20 23. A waveguide assembly according to Claim 13, wherein the waveguide region further includes a cladding at least partially surrounding the core for confining signals within the core, wherein the at least one PhC region further extends laterally through at least a portion of the cladding such that the at least one PhC region is capable of covering the incident light mode width of a signal propagating through the waveguide region.

25 24. A waveguide assembly comprising:
a waveguide region; and
at least one photonic crystal (PhC) region extending laterally through at least a portion of the waveguide region to at least partially direct signals propagating through the waveguide region, wherein the at least one PhC region extends laterally through at least a
30 portion of the waveguide region such that the at least one PhC region is further capable of

covering the incident light mode width of a signal propagating through the waveguide region.

25. A waveguide assembly according to Claim 24, wherein the at least one
5 PhC region extends laterally through at least a portion of the waveguide region to thereby form a bend for signals propagating through the waveguide region.

26. A waveguide assembly according to Claim 25, wherein the waveguide
region includes a longitudinally extending core, wherein each PhC region includes a
10 boundary layer at a boundary of the PhC region and the core of the waveguide region, and wherein the boundary layer is capable of being modified to thereby manipulate a diffraction effect caused by a periodicity at the boundary of the at least one PhC region and the core.

15 27. A waveguide assembly according to Claim 26, wherein the boundary layer of each PhC region comprises an array of a plurality of one of holes and posts, and wherein the boundary layer is capable of being modified by changing at least one of a radius, periodicity and position of the one of holes and posts of the boundary layer.

20 28. A waveguide assembly according to Claim 24, wherein the at least one PhC region extends laterally through at least a portion of the waveguide region to thereby form a beamsplitter for signals propagating through the waveguide region.

25 29. A waveguide assembly according to Claim 28, wherein the at least one PhC region extends laterally through at least a portion of the waveguide region to thereby form a polarizing beamsplitter for signals propagating through the waveguide region.

30. A waveguide assembly according to Claim 29, wherein the waveguide
region includes a longitudinally extending core, wherein a portion of the core through
30 which the at least one PhC region extends can be configured to follow a propagation direction of polarized signals propagating through the core.

31. A waveguide assembly according to Claim 30, wherein the core of the waveguide region includes an input channel and first and second output channels, and wherein a portion of the first output channel through which the PhC region extends is
5 sloped with respect to the input channel.

32. A waveguide assembly according to Claim 24, wherein the at least one PhC region extends laterally through at least a portion of the waveguide region to thereby form a Mach-Zender interferometer for signals propagating through the waveguide
10 region.

33. A waveguide assembly according to Claim 24, wherein the at least one PhC region extends laterally through at least a portion of the waveguide region to thereby form a ring resonator for signals propagating through the waveguide region.
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34. A waveguide assembly according to Claim 24, wherein signals having a wavelength outside a band gap of the at least one PhC region are capable of propagating through the waveguide region.
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